

Digitalization: Shaping the Future of Manufacturing

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Even Experienced Managers Continue to Face Hurdles

Aubrey, an experienced operations manager at an ammonia plant, starts her day early, meticulously reviewing overnight reports and data over a fresh cup of coffee still hot inside her Stanley thermos. She brings her own, as the plant java juice doesn't quite meet her taste profile standards. As a major backbone of the plant's operations, she is responsible for ensuring smooth, efficient, and safe production processes. With the rising demand for green energy and sustainable practices, Aubrey faces the challenge of integrating digital transformation (DX) solutions into the plant's existing systems. It's not a matter of if, it's a matter of when.



She would also like to introduce Autothermal Reforming (ATR) technology for the low-carbon, mass production of hydrogen (H₂) to be combined with nitrogen (N₂) to make ammonia (NH₃). This will reduce operating expenses and emissions at the same time. Double win. She has some buy-in from the senior management, but before she takes this step, Aubrey chooses to first streamline her current operations, which will make the task of integrating new technology easier.

What is Keeping Aubrey Up at Night

The plant still has legacy OT systems that pose significant challenges in a modern ammonia manufacturing environment due to their limited functionality, which can prevent the adoption of advanced technologies and tools needed to keep up with current production demands. These systems often require costly and hard-to-find maintenance and support as they age, and they lack robust cybersecurity measures, making them vulnerable to cyber threats. Additionally, integrating legacy systems with new technologies can be complex and expensive, frequently necessitating extensive customization or complete system overhauls.

Proprietary systems also create obstacles, such as vendor lock-in, which limit flexibility and can lead to higher costs for updates and support. These systems often struggle with interoperability, hindering the creation of a cohesive manufacturing environment and stifling innovation due to reliance on vendor-provided capabilities. Furthermore, a lack of system integration results in data silos, inefficiencies, and delays in responding to production changes, while the absence of predictive modeling leads to reactive maintenance, missed optimization opportunities, and limited operational insights.

The Convincing Benefits of Digital Transformation

Aubrey's smart. She studied chemical engineering at Stanford. She's learned from some of her AIChE counterparts that digital transformation (DX) can leverage automation, real-time data analytics, and AI to streamline processes, reduce downtime, and optimize production lines, resulting in significant gains in efficiency and productivity. Her plant would benefit considerably from this. She also believes that DX can facilitate predictive maintenance through advanced analytics, helping to anticipate on-site equipment failures before they occur, thereby reducing unplanned downtime and maintenance costs. This would be a major win for her and her company.



Strategic Goals and Workforce Planning

The plant's digital transformation journey begins with setting clear strategic goals. Aubrey collaborates with senior management to outline these objectives, focusing on enhancing operational efficiency, reducing downtime, and minimizing environmental impact. She then assesses the workforce and workflow needed to achieve these goals, identifying skill gaps and training requirements.



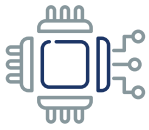
Assessing the Current State with S.I.R.I.

With goals and workforce plans in place, Aubrey initiates a Smart Industry Readiness Index (S.I.R.I.) assessment. This process evaluates the plant's current IT and OT infrastructure, providing a comprehensive understanding of its digital maturity. The SIRI assessment highlights areas for improvement and helps Aubrey prioritize investments in new technologies. She is also able to identify and integrate necessary IT/OT components based on the assessment. These expert SIRI consultants provide strategic guidance, helping Aubrey break down the DX journey into achievable steps. They assist in customizing solutions to meet the specific needs of the ammonia plant such as integrating the necessary IT/OT components.



Integrating Digital Twin Technology

Aubrey introduces the concept of the digital twin to the team. This virtual replica of the plant enables real-time monitoring and optimization of operations. By simulating different scenarios, Aubrey can predict potential issues and implement preventive measures, significantly reducing unplanned downtime and maintenance costs. The digital twin also facilitates better decision-making by providing a holistic view of the plant's performance.



Robotics and Automation

Next on Aubrey's agenda is the integration of robotics and automation. She oversees the deployment of robot and drone technology and plant analyzers, enhancing precision and efficiency across the plant. These robots perform repetitive and hazardous tasks, improving safety and ergonomics for the workforce while reducing labor costs.



Enhancing Cybersecurity

As the plant becomes increasingly connected, cybersecurity emerges as a critical concern. Aubrey collaborates with IT experts to implement robust cybersecurity measures, safeguarding the plant's data and operations from potential cyber threats. This proactive approach ensures the integrity and reliability of the plant's digital infrastructure.



Leveraging the Cloud

Aubrey adopts a Cloud platform to streamline data management and enhance collaboration. This platform supports data ingestion, processing, and curation, providing industry-specific algorithms and models for insightful decision-making. The centralized data management system ensures data security and privacy while enabling scalability and flexibility.



The Supply Chain Roadmap

Aubrey also focuses on digitizing the supply chain from feedstock to finished product. By doing this she is able to enhance visibility and integration across the supply chain, implement real-time monitoring and predictive maintenance, optimize inventory management and reduce lead times to improve coordination and communication among supply chain partners.



The ISA 95 Path

(The international standard for the integration of enterprise and control systems)

Following the ISA 95 framework, Aubrey maps out additional applications for digital transformation. She is sure to include field devices by integrating advanced sensors and IoT devices for real-time monitoring and control systems, which use digital twin technology for process optimization. In addition, a new MES (Manufacturing Execution System) provides interoperability with mobile robotics and automation platforms for efficient production and an updated ERP (Enterprise Resource Planning) system Leverages the Cloud for centralized data management.



Making the Most out of New Systems

Aubrey's DX journey concludes with finalizing new procedures and documentation, updating management of change procedures to reflect new practices, and conducting training sessions to ensure the workforce is adept at using the new systems.

The Future of Automation and Digital Transformation

Aubrey envisions a future where emerging technologies continue to revolutionize industrial manufacturing. With advanced solutions, the plant stays competitive, innovative, and sustainable. Aubrey's journey showcases the strategic importance of embracing digital transformation to meet evolving market demands and achieve operational excellence.



Conclusion

Aubrey's experience highlights the transformative power of DX in an ammonia plant. By leveraging automation, real-time data analytics, and AI, Aubrey was able to optimize production processes, enhance quality control, and ensure predictive maintenance. Despite challenges such as legacy systems and lack of integration, Aubrey successfully navigated the digital landscape, securing a sustainable and competitive advantage for the future of her plant.

Yes, I'd Love to Learn More

